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Abstract—This manual shows how to teach C programming to beginners using the arduino and a seven segment display. All basic concepts like conditional statements, loops, arrays and functions are covered.

Problem 1. Connect the arduino to the seven segment display in Fig. 1.

Component	Value	Quantity
Breadboard		1
Resistor	$\geq 220\Omega$	1
Arduino	Uno	1
Seven Segment Display	Common Anode	1
Jumper Wires		20

TABLE 1

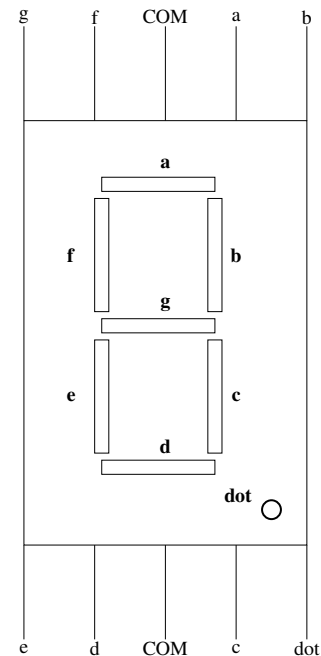


Fig. 1

Problem 2. Run the following program and test for dec=0 and dec=8.

```
//Code released under GNU GPL.
  Free to use for anything.
//Remove the following line if you
  are using the Arduino IDE
#include "Arduino.h"

int dec = 8;
void setup()
{
  // initialize LED digital pin as
  an output.
  pinMode(2, OUTPUT); // a
  pinMode(3, OUTPUT); // b
  pinMode(4, OUTPUT); // c
```

```
  pinMode(5, OUTPUT); // d
  pinMode(6, OUTPUT); // e
  pinMode(7, OUTPUT); // f
  pinMode(8, OUTPUT); // g
}

void loop()
{
  if (dec==8)
  {
    digitalWrite(2,0);
    digitalWrite(3,0);
    digitalWrite(2,0);
    digitalWrite(5,0);
    digitalWrite(6,0);
    digitalWrite(7,0);
    digitalWrite(8,0);
```

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```

}
else if (dec==0)
{
    digitalWrite(2,0);
    digitalWrite(3,0);
    digitalWrite(2,0);
    digitalWrite(5,0);
    digitalWrite(6,0);
    digitalWrite(7,0);
    digitalWrite(8,1);
}
}

```

Problem 3. Extend the previous program for all numbers between 0-9. Print E on the display if the input is not in this range.

Problem 4. Write a function for writing a decimal number to the seven segment display.

```

//Code released under GNU GPL.
//Free to use for anything.
//Remove the following line if you
//are using the Arduino IDE
#include "Arduino.h"

void sevensseg(int);
void setup()
{
    // initialize LED digital pin as
    // an output.
    pinMode(2, OUTPUT); //a
    pinMode(3, OUTPUT); //b
    pinMode(4, OUTPUT); //c
    pinMode(5, OUTPUT); //d
    pinMode(6, OUTPUT); //e
    pinMode(7, OUTPUT); //f
    pinMode(8, OUTPUT); //g
}

void loop()
{
    sevensseg(0);
}

void sevensseg(int dec)
{
    int a=0,b=0,c=0,d=0,e=0,f
    =0,g=0;

```

```

switch (dec)
{
    case 0:
        g=1;
        break;
    case 1:
        a=1,d=1,e
        =1,f=1,g
        =1;
        break;
    case 2:
        c=1,f=1;
        break;
    case 3:
        e=1,f=1;
        break;
    case 4:
        a=1,d=1,e
        =1;
        break;
    case 5:
        b=1,e=1;
        break;
    case 6:
        b=1;
        break;
    case 7:
        d=1,e=1,f
        =1,g=1;
        break;
    case 8:
        break;
    case 9:
        e=1;
        break;
    default:
        b=1,c=1;
        break;
}
digitalWrite(2,a);
digitalWrite(3,b);
digitalWrite(4,c);
digitalWrite(5,d);
digitalWrite(6,e);
digitalWrite(7,f);
digitalWrite(8,g);
}

```

Problem 5. Using the function in problem 4 and a for loop, implement a decade counter.

```
//Code released under GNU GPL.
  Free to use for anything.
//Remove the following two lines
  if you are using the Arduino IDE
//and include the sevenseg
  function definition after the
  loop function
#include "Arduino.h"
#include "sevenseg.h"

int i;
void sevenseg(int);
void setup()
{
  // initialize LED digital pin as
  an output.
  pinMode(2, OUTPUT); //a
  pinMode(3, OUTPUT); //b
  pinMode(4, OUTPUT); //c
  pinMode(5, OUTPUT); //d
  pinMode(6, OUTPUT); //e
  pinMode(7, OUTPUT); //f
  pinMode(8, OUTPUT); //g
}

void loop()
{
  for(i=0; i < 10; i++)
  {
    sevenseg(i);
    delay(1000);
  }
}
```

Problem 6. Repeat problem 4 using an array for pin numbering.

```
//Code released under GNU GPL.
  Free to use for anything.
//Remove the following line if you
  are using the Arduino IDE
#include "Arduino.h"

void sevenseg(int);
```

```
void setup()
{
  // initialize LED digital pin as
  an output.
  pinMode(2, OUTPUT); //p[0]=a
  pinMode(3, OUTPUT); //p[1]=b
  pinMode(4, OUTPUT); //p[2]=c
  pinMode(5, OUTPUT); //p[3]=d
  pinMode(6, OUTPUT); //p[4]=e
  pinMode(7, OUTPUT); //p[5]=f
  pinMode(8, OUTPUT); //p[6]=g
}

void loop()
{
  sevenseg(0);
}

void sevenseg(int dec)
{
  int p[7], i;

  for (i=0; i < 7; i++)
    p[i] = 0;

  switch (dec)
  {
    case 0:
      p[6]=1;
      break;
    case 1:
      p[0]=1, p
      [3]=1, p
      [4]=1, p
      [5]=1, p
      [6]=1;
      break;
    case 2:
      p[2]=1, p
      [5]=1;
      break;
    case 3:
      p[4]=1, p
      [5]=1;
      break;
    case 4:
      p[0]=1, p
      [3]=1, p
      [4]=1;
      break;
  }
}
```

```

    case 5:
        p[1]=1,p
        [4]=1;
        break;
    case 6:
        p[1]=1;
        break;
    case 7:
        p[3]=1,p
        [4]=1,p
        [5]=1,p
        [6]=1;
        break;
    case 8:
        break;
    case 9:
        p[4]=1;
        break;
    default:
        p[1]=1,p
        [2]=1;
        break;
}

for (i=0;i < 7; i++)
    digitalWrite(i+2,p
        [i]);
}

```

Problem 7. Repeat problem 2 by using the switch-case statements.

Problem 8. Repeat problem 5 by using a while loop.

Problem 9. Repeat 5 using a do-while loop.

Problem 10. Implement decimal to binary conversion and test your logic using the display.

```

//Code released under GNU GPL.
Free to use for anything.
//Remove the following line if you
are using the Arduino IDE
#include "Arduino.h"

void binsevenseg(int ,int ,int ,int );
void setup()

```

```

{
    int i;
    // initialize LED digital pin as
    an output.
    for (i=0;i < 7; i++)
        pinMode(i+2,
            OUTPUT);
}

void loop()
{
    int dec = 5;
    int E,F,G,H;

    //decimal to binary conversion
    E = dec%2;
    dec = dec/2;
    F = dec%2;
    dec = dec/2;
    G = dec%2;
    dec = dec/2;
    H = dec%2;

    binsevenseg(E,F,G,H);
}

//function for binary to seven
segment display
void binsevenseg(int A, int B, int
    C, int D)
{
    int p[7],i;

    p[0] = A&&!B&&!C&&!D || !A&&!B&&C
        &&!D;
    p[1] = A&&!B&&C&&!D || !A&&B&&C&&!
        D;
    p[2] = !A&&B&&!C&&!D;
    p[3] = A&&!B&&!C&&!D || !A&&!B&&C
        &&!D || A&&B&&C&&!D;
    p[4] = A&&!B&&!C&&!D || A&&B&&C
        &&!D || !A&&!B&&C&&!D || A&&!B&&
        C&&!D || A&&B&&C&&!D || A&&!B&&!
        C&&!D;
    p[5] = A&&!B&&!C&&!D || !A&&B&&C
        &&!D || A&&B&&C&&!D || A&&B&&C
        &&!D;
    p[6] = !A&&!B&&C&&!D || A&&!B&&C
        &&!D || A&&B&&C&&!D;
}

```

```
    for (i=0; i < 7; i++)  
        digitalWrite(i+2,p  
            [i]);  
}
```

Problem 11. Implement decimal to binary conversion using a for loop and arrays.

Problem 12. Repeat the above exercise using a while loop.

Problem 13. Repeat the above exercise using a do-while loop.

Problem 14. Repeat the above exercise by using a function.